

ART. IV.—*The Anatomy of Caryodes dufresnyi*, Leach

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(With Plate IV.).

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Introduction.

Most of the specimens with which this work was carried out were collected by Mr. C. French, at Port Esperance, N.W. Tasmania, and sent to Mr. Kershaw, at the National Museum, who kindly gave them to me to work out their anatomy.

Two other specimens, one of which was immature, were collected by Miss Raff, M.Sc., at Mount Wellington, Tasmania.

Caryodes dufresnyi was named and first described by Leach as a *Helix*; Zoological Miscellany, vol. 2, pp. 153, 154. pl. 120.

A short account of the anatomy, mostly of the reproductive system, has been given by Semper, in *Reis. im Philip.*, vol. iii. p. 102, pl. xvi., f. 7.

Mr. C. Hedley, F.L.S., has given us a description and a figure in the *Proc. Linn. Soc.*, N.S.W. (2), vi., 1891, p. 19, pl. ii., f. 1a, pl. iii., f. 1; and some further information as to its systematic position in the *Rec. Austr. Mus.*, ii. 1892, p. 29.

Other descriptions, chiefly of the shell, have been given by Quoy and Gaimard, in the *Voyage of the Astrolabe*, vol. ii., pl. x., f. 1; and by Adams, in the *Genera of Recent Mollusca*, vol. 2, pp. 146 and 153.

After having been described by Leach as a *Helix*, *Caryodes dufresnyi* was described as *Bulimus dufresnyi*. The genus *Bulimus* according to Cox, possesses the following characteristics:—"Shell oblong or turreted, aperture with unequal longitudinal margins, toothless or dentate; columella entire, revolute externally or simple; peristome simple or expanded." While Semper adds:—"A parallel ridged jaw. Teeth similar, in straight or curved rows. Shell long, with thick mouth edge. The kidney is, in spite of the long lung, as short as the pericardium; it is three cornered."

genital organs are quite simple, without accessory organs; there may be a flagellum."

The genus *Caryodes* possesses the following characters, as given by Semper :—"Foot as usual, on the left of the edge of the mantle there is a neck fold. There is a very peculiarly-structured accessory gland to the sheath (Scheide) (homologous to dart sac). Jaw smooth. Teeth all unicuspid (as in *Acavus*).

"For the characters of the shell, see Albers."

External Features and General Description.

As I was unable to procure any living specimens of *Caryodes dufresnyi*, I had to take the following description and measurements from preserved animals.

Shell: Height, 37 mms.; greatest diameter, 12 mms. Mouth Opening: Height, 10.5 mms.; width, 6 mms. Whorls, 5. Colour brown or brownish green, with darker brown and yellow bands. There is no umbilicus.

The foot of an average specimen, preserved in spirit, measured 25 mm. in length. The animal itself was greyish brown, with a lighter grey colour along the sole of the foot.

Organs of the Mantle Cavity.

The Mantle cavity is very long and narrow; the kidney and heart are situated at the posterior end of it; the blood vessels are large and well marked.

The Kidney is a somewhat triangular organ, with a depression on one side, into which the heart is fitted, and its apex directed forwards. Arising from the apex is a bladder-like structure, which runs backwards, down one side of the kidney and partly round its base, to open about half way along this into the pulmonary chamber.

The Heart. The auricle is rather large compared with the ventricle. It is extremely thin, being little more than a membranous sac. The ventricle has thick walls and a small lumen. The heart is surrounded by the pericardium, an extremely thin membrane, in some places very difficult to make out in the sections.

The Renopericardial canal can be seen very distinctly in section, one of which is represented in Fig. III. It is a short canal leading from the pericardial cavity into the kidney; the canal is lined along its length by very definite, ciliated, columnar cells.

The Reproductive System.

The Hermaphrodite gland lies close to the internal surface of the third coil of the visceral mass. It is a rosette shaped gland, composed of a number of finger-like processes united at the centre of the gland.

The Hermaphrodite duct is a sinuous duct running from the hermaphrodite gland to the albumen gland. It leaves the hermaphrodite gland from about its centre and runs to near the anterior end of the albumen gland, turns back, lying closely applied to the gland, and enters it about its centre on the under surface.

The Albumen gland is a large compact gland lying behind and partly under the mantle cavity. It is incompletely divided by deep furrows, which give it the appearance of being somewhat lobed.

The Common duct leaves the albumen gland from its anterior end, and passes forwards, where it divides into vas deferens and oviduct.

The Vas deferens is a long slender tube, which, on leaving the common duct, passes round and under a peculiar gland, which I shall call the shell gland, and the oviduct, up to the anterior end, where it then turns and runs backwards, to enter the penis on the under surface at the posterior end.

The Penis is large and strongly muscular. At the posterior end the retractor penis muscle connects it with the body wall. It opens to the exterior beside the female opening.

The Oviduct is a broad tube leading from the common duct to the exterior. Shortly after leaving the common duct, the oviduct receives the opening of a large wide gland, which appears to function as a shell gland.

The gland which I heard call the shell gland is a large thick-walled gland, receiving the duct of the receptaculum seminis, near its anterior end. Internally the lining of the gland is thrown into very large folds, and lying in the grooves between these I found small deposits of calcium carbonate.

This is the structure referred to by Semper as a long thick sac, to the under sheathing of which the uterus and long drawn out receptaculum seminis are placed, and to its base a retractor. This sac cut open contains a sausage shaped body, which is free at the hinder end, and appears rounded at the end; its outer wall was thickly wrinkled and covered with thick epithelium, in the creases of which lay calcium carbonate in irregular plates. He then goes on to give a description of the arrangement of the muscles of this organ.

In transverse section there is seen to be a thin external membrane; underlying this there is a layer of muscular tissue; and lining the lumen of the gland ciliated columnar epithelium, composed of very long narrow cells, very granular at their bases and with many vacuoles. Down one side of the gland is a specially-marked fold, probably the one to which Semper refers. In section this is seen to be composed of muscular tissue, amongst which is scattered some brown material, with no definite structure, and is probably some kind of secretion.

The *Receptaculum Seminis* is a globular body connected by a long thin duct with the shell gland.

The Alimentary System.

The Jaw is simple and smooth.

The *Radula* consists of a number of rows of similar unicuspid teeth, one of which is shown in Fig. VIb.

The Mouth opens into a very narrow oesophagus, which is closely surrounded by the salivary glands. The large strong retractor muscles run from either side of the ventral surface of the buccal mass, and uniting, run along the length of the foot. These muscles are of use in the biting and tearing of the food.

The Oesophagus leads into a fairly large stomach, which bends back on itself, so that its anterior end and its posterior end lie side by side. The stomach leads by a long intestine, which twists amongst the liver mass, receiving the ducts from this, and finally ends in the rectum, which runs along the side of the length of the long pulmonary chamber, to open to the exterior at the respiratory opening.

The Salivary glands completely surround the anterior end of the oesophagus, being fused in the mid-dorsal line. Their ducts open into the hinder part of the buccal cavity.

The Liver is a large brown organ occupying by far the larger part of the visceral hump. The intestine passes through it, and receives its ducts near to its anterior end. In it are also embedded the Hermaphrodite gland and the Hermaphrodite duct, while the Albumen gland lies closely fitted into a depression on its ventral surface, being almost completely hidden by it.

The above work was carried out in the Melbourne University, under the direction of Professor Spencer, whom I wish to thank for all his advice. I also wish to thank Mr. J. Brake, B.Sc., who kindly took the photograph represented in Fig. I. for me.

Literature.

- Adams.—Genera of Recent Mollusca, vol. ii. pp. 146 and 153.
Cox.—Monograph of Australian Land Mollusca.
Hedley, C., F.L.S.—Proc. Linn. Soc., N.S.W. (2), vi., 1891, p. 19.
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Semper.—Reis. im Philip., vol. iii., p. 102, pl. xvi., f. 7.
Quoy and Gaimard.—Voyage of the Astrolabe, vol. ii., pl. x., f. 1.
Leach.—Zoological Miscellany, vol. ii. pp. 153-154, pl. 120.

EXPLANATION OF PLATES.

In all figures :—

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| An. | Anus. |
| A.G. | Albumen gland. |
| Aur. | Auricle. |
| B.M. | Buccal mass. |
| B.V. | Blood vessel. |
| C. | Cilia. |
| C.D. | Common duct. |
| C.G. | Cerebral ganglia. |
| C.G.A. | Common genital atrium. |
| H.D. | Hermaphrodite duct. |
| H.G. | Hermaphrodite gland. |
| K. | Kidney. |
| L. | Liver. |
| M.C. | Mantle cavity. |
| O. | Oesphagus. |
| OD. | Oviduct. |
| P. | Penis. |
| P.C. | Pericardium. |
| R. | Rectum. |
| R.M. | Retractor muscle. |
| R.P.C. | Renopericardial canal. |
| R.S. | Receptaculum seminis. |
| Sa.G. | Salivary gland. |
| S.G. | Shell gland. |
| T.S. | Superior tentacle. |
| V. | Ventricle. |
| V.D. | Vas deferens. |
| V.H. | Visceral hump. |

Fig. I.—*Bulimus dufresnyi* (Shell) from a photograph.

Fig. II.—Dissection of *Bulimus dufresnyi*, to show general position of the organs.

Fig. III.—Section across the Kidney and Heart, showing the Renopericardial canal.

Fig IV.—The Reproductive System.

Fig. V.—The Reproductive System dissected out, to show the course of the vas deferens, and the shell gland.

Fig. VI.—(A) Portion of Radula, showing teeth in position. (B) Single tooth.